

# 13.6 EXERCISES

**HOMEWORK KEY**

**WORKED-OUT SOLUTIONS**  
on p. WS1 for Exs. 17, 25, and 45  
**STANDARDIZED TEST PRACTICE**  
Exs. 2, 20, 33, 34, 45, and 47

## 4 PRACTICE AND APPLY

### Assignment Guide

**Answer Transparencies**  
available for all exercises

#### Basic:

Day 1: pp. 892–894  
Exs. 1–20, 55–62  
Day 2: pp. 892–894  
Exs. 21–29, 33, 43–46, 49–54

#### Average:

Day 1: pp. 892–894  
Exs. 1–10, 14–17, 20, 36–41, 55–62  
Day 2: pp. 892–894  
Exs. 24–35, 43–47, 49–54

#### Advanced:

Day 1: pp. 892–894  
Exs. 1–7, 15–20, 36–42\*, 55–62  
Day 2: pp. 892–894  
Exs. 26–35, 43–54\*

#### Block:

pp. 892–894  
Exs. 1–10, 14–17, 20, 24–41, 43–47,  
49–62

### Differentiated Instruction

See *Algebra 2 Best Practices Toolkit* for suggestions on addressing the needs of a diverse classroom.

### Homework Check

For a quick check of student understanding of key concepts, go over the following exercises:

**Basic:** 8, 14, 24, 43, 44

**Average:** 10, 16, 28, 43, 45

**Advanced:** 16, 18, 30, 44, 45

### Extra Practice

- Student Edition, p. 1022
- Chapter 13 Resource Book:  
Practice levels A, B, C, pp. 63–65

### Practice Worksheet

An easily-readable reduced practice page (with answers) for this lesson can be found on p. 850C.

## SKILL PRACTICE

- 1. VOCABULARY** Copy and complete: In a triangle with sides of length  $a$ ,  $b$ , and  $c$ ,  $\frac{1}{2}(a + b + c)$  is called the semiperimeter.

- 2. ★ WRITING** Express Heron's formula in words. **See margin.**

### EXAMPLES 1 and 2

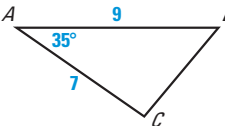
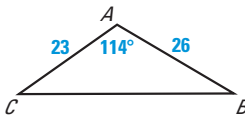
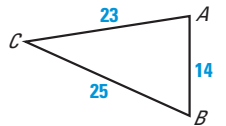
on pp. 889–890  
for Exs. 3–20

**2. The area of a triangle is equal to the square root of the product of the semiperimeter of the triangle and the difference between the semiperimeter and each of the sides of the triangle.**

**CHOOSING A METHOD** For the given case, tell whether you would use the *law of sines* or the *law of cosines* to solve the triangle.

3. SSS **law of cosines**    4. ASA **law of sines**    5. SSA **law of sines**    6. SAS **law of cosines**    7. AAS **law of sines**

**SOLVING TRIANGLES** Solve  $\triangle ABC$ .

8.   $B \approx 50.8^\circ$ ,  $C \approx 94.2^\circ$ ,  $a \approx 5.18$
9.   $B \approx 30.7^\circ$ ,  $C \approx 35.3^\circ$ ,  $a \approx 41.1$
10.   $A \approx 81.1^\circ$ ,  $B \approx 65.4^\circ$ ,  $C \approx 33.5^\circ$

**SOLVING TRIANGLES** Solve  $\triangle ABC$ .

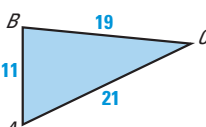
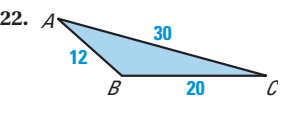
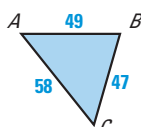
11.  $B = 25^\circ$ ,  $a = 8$ ,  $c = 6$     12.  $A = 103^\circ$ ,  $b = 15$ ,  $c = 24$     13.  $a = 18$ ,  $b = 28$ ,  $c = 13$   
 $A \approx 110.4^\circ$ ,  $C \approx 44.6^\circ$ ,  $b \approx 3.60$      $B \approx 28.0^\circ$ ,  $C \approx 49.0^\circ$ ,  $a \approx 31.0$      $A \approx 30.3^\circ$ ,  $B \approx 128.4^\circ$ ,  $C \approx 21.3^\circ$
14.  $a = 38$ ,  $b = 31$ ,  $c = 35$     15.  $C = 48^\circ$ ,  $a = 17$ ,  $b = 20$     16.  $B = 63^\circ$ ,  $a = 29$ ,  $c = 38$   
 $A \approx 70.0^\circ$ ,  $B \approx 50.1^\circ$ ,  $C \approx 59.9^\circ$      $A \approx 55.7^\circ$ ,  $B \approx 76.3^\circ$ ,  $c \approx 15.3$      $A \approx 46.0^\circ$ ,  $C \approx 71.0^\circ$ ,  $b \approx 35.8$
17.  $a = 10$ ,  $b = 3$ ,  $c = 12$     18.  $a = 23$ ,  $b = 24$ ,  $c = 20$     19.  $C = 96^\circ$ ,  $a = 35$ ,  $b = 43$   
 $A \approx 42.6^\circ$ ,  $B \approx 11.7^\circ$ ,  $C \approx 125.7^\circ$      $A \approx 62.2^\circ$ ,  $B \approx 67.4^\circ$ ,  $C \approx 50.4^\circ$      $A \approx 36.7^\circ$ ,  $B \approx 47.3^\circ$ ,  $c \approx 58.2$
20. **★ MULTIPLE CHOICE** What is the measure of angle  $B$  in  $\triangle ABC$  if  $a = 17$ ,  $b = 29$ , and  $c = 14$ ? **D**

- (A)  $18.7^\circ$     (B)  $22.9^\circ$     (C)  $111.2^\circ$     (D)  $138.4^\circ$

### EXAMPLE 4 B

on p. 891  
for Exs. 21–33

**FINDING AREA** Find the area of  $\triangle ABC$ .

21.  about 104 units<sup>2</sup>
22.  about 80.5 units<sup>2</sup>
23.  about 1108.6 units<sup>2</sup>

**FINDING AREA** Find the area of  $\triangle ABC$  with the given side lengths.

24.  $a = 12$ ,  $b = 7$ ,  $c = 8$     25.  $a = 5$ ,  $b = 11$ ,  $c = 10$     26.  $a = 25$ ,  $b = 24$ ,  $c = 19$   
about 26.9    about 25.0    about 214.2
27.  $a = 14$ ,  $b = 20$ ,  $c = 28$     28.  $a = 31$ ,  $b = 23$ ,  $c = 17$     29.  $a = 81$ ,  $b = 67$ ,  $c = 71$   
about 131.9    about 192.2    about 2259.7
30.  $a = 43$ ,  $b = 59$ ,  $c = 48$     31.  $a = 51$ ,  $b = 51$ ,  $c = 43$     32.  $a = 38$ ,  $b = 25$ ,  $c = 61$   
about 1018.2    about 994.3    about 234.6
33. **★ MULTIPLE CHOICE** What is the area of  $\triangle ABC$  if  $a = 21$ ,  $b = 16$ , and  $c = 13$ ? **B**

- (A) 66 units<sup>2</sup>    (B) 104 units<sup>2</sup>    (C) 1350 units<sup>2</sup>    (D) 4368 units<sup>2</sup>

34. **★ SHORT RESPONSE** Use the law of cosines to show that the measure of each angle of an equilateral triangle is  $60^\circ$ . *Explain your reasoning.* **See margin.**

34.  $x^2 = x^2 + x^2 - 2(x)(x) \cos A \rightarrow \frac{-x^2}{-2x^2} = \cos A \rightarrow \frac{1}{2} = \cos A \rightarrow A = 60^\circ$ .  
**Sample answer:** Since all of the sides are the same, the angles opposite those sides will also be the same.

35. **ERROR ANALYSIS** Describe and correct the error in finding the measure of angle  $A$  in  $\triangle ABC$  if  $a = 18$ ,  $b = 15$ , and  $c = 10$ .

$$\cos A = \frac{15^2 + 10^2 - 18^2}{2(15)(10)} \approx 0.0019$$

$$A \approx \cos^{-1} 0.0019 \approx 89.9^\circ$$

Since you are looking for  $A$  the equation should be  $a^2 = b^2 + c^2 - 2bc \cos A$ ;  $18^2 = 15^2 + 10^2 - 2(15)(10) \cos A$ ,  $A \approx \cos^{-1} 0.0033 \approx 89.8^\circ$ .  
**CHOOSING A METHOD** Use the law of sines, the law of cosines, or the Pythagorean theorem to solve  $\triangle ABC$ .

40.  $A \approx 81.0^\circ$ ,  
 $B \approx 59.0^\circ$ ,  $a \approx$   
 $41.5$  or  $A \approx 19.0^\circ$ ,  
 $B \approx 121.0^\circ$ ,  
 $a \approx 13.7$

**C**

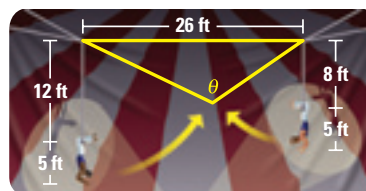
36.  $A = 72^\circ$ ,  $B = 44^\circ$ ,  $b = 14$     37.  $B = 98^\circ$ ,  $C = 37^\circ$ ,  $a = 18$     38.  $C = 65^\circ$ ,  $a = 12$ ,  $b = 21$   
 $C = 64^\circ$ ,  $a \approx 19.2$ ,  $c \approx 18.1$      $A = 45^\circ$ ,  $b \approx 25.2$ ,  $c \approx 15.3$      $A \approx 34.3^\circ$ ,  $B \approx 80.7^\circ$ ,  $c \approx 19.3$   
 39.  $B = 90^\circ$ ,  $a = 15$ ,  $c = 6$     40.  $C = 40^\circ$ ,  $b = 36$ ,  $c = 27$     41.  $a = 34$ ,  $b = 19$ ,  $c = 27$   
 $A \approx 68.2^\circ$ ,  $C \approx 21.8^\circ$ ,  $b \approx 16.2$      $A \approx 93.7^\circ$ ,  $B \approx 33.9^\circ$ ,  $C \approx 52.4^\circ$
42. **CHALLENGE** Given  $\triangle ABC$  with height  $h$ , derive the law of cosines. Explain how the Pythagorean theorem is related to the law of cosines. See margin.

## PROBLEM SOLVING

**EXAMPLE 3** **A**  
 on p. 890  
 for Ex. 43

43. **TRAPEZE ARTISTS** The diagram shows the paths of two trapeze artists who are both 5 feet long when hanging by their knees. The “flyer” on the left bar is preparing to make hand-to-hand contact with the “catcher” on the right bar. At what angle  $\theta$  will the two meet? **about  $119.6^\circ$**

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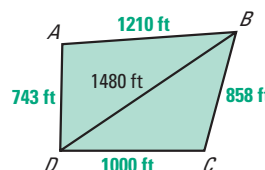


**EXAMPLE 4**  
 on p. 891  
 for Exs. 44–45

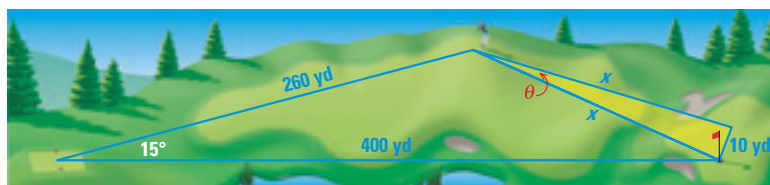
44. **RESEARCH TRIANGLE** Raleigh, Durham, and Chapel Hill are three cities in North Carolina that form what is known as the Research Triangle. It is about 18 miles from Raleigh to Durham, 23 miles from Raleigh to Chapel Hill, and 8 miles from Chapel Hill to Durham. Find the area of the Research Triangle. **about  $63 \text{ mi}^2$**

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45. **★ SHORT RESPONSE** The diagram shows the dimensions of a plot of land. What is the area of the land in acres? (Use the fact that 1 acre = 43,560 square feet.) Explain how you could also determine the area by first finding the length of  $\overline{AC}$ . **About 19.8 acres. Sample answer: Find  $\overline{AC}$  then find the area of  $\triangle ACD$  and  $\triangle ABC$  using Heron's formula.**



- B** 46. **MULTI-STEP PROBLEM** A golfer hits a drive 260 yards on a hole that is 400 yards long. The shot is  $15^\circ$  off target.



- a. What is the distance  $x$  from the golfer's ball to the hole? **about 163 yd**  
 b. Assume the golfer is able to hit the ball precisely the distance found in part (a). What is the maximum angle  $\theta$  by which the ball can be off target in order to land no more than 10 yards from the hole? **about  $3.52^\circ$**

## Avoiding Common Errors

**Exercises 8–33** When students use calculators, emphasize that they must take care in entering numbers and symbols. They should pay special attention to the need for parentheses. Once they have an answer, they should check to see that it makes sense. If not, they may have made errors in keying in numbers or symbols.

**Exercises 24–32** Some students may use the perimeter, rather than the semiperimeter, in one or more places where  $s$  appears in Heron's formula. Have these students write the formula in their notebooks, along with the equation  $s = \frac{1}{2}(a + b + c)$ .

Teach them to always compute the semiperimeter first, and to write down the value of  $s$ , but *not* the perimeter of the triangle before they start substituting into Heron's formula.

## Teaching Strategy

### Exercises 13, 14, 17, 18, 20

Although it is true that three sides determine exactly one triangle (or, equivalently, that SSS is a congruence condition), students should understand that this does not mean that a triangle exists with *any* three side lengths. After they have solved  $\triangle ABC$  with the side lengths given in Exercise 13, ask them to repeat the process with  $a = 18$ ,  $b = 28$ , and  $c = 9$ . The first time they try to find an angle measure with the law of cosines, using their calculators, they will get an ERROR message. Ask them why this happens. This provides a good opportunity to review the triangle inequality from their geometry course.

**42. See Additional Answers beginning on p. AA1.**

## 5 ASSESS AND RETEACH

### Daily Homework Quiz

#### Transparency Available

Solve  $\triangle ABC$  with the given parts.

- $B = 77^\circ$ ,  $a = 25$ ,  $c = 35$   
 $b \approx 38.2$ ,  $A \approx 39.7^\circ$ ,  $C \approx 63.3^\circ$
- $a = 45$ ,  $b = 56$ ,  $c = 78$   
 $A \approx 34.5^\circ$ ,  $B \approx 44.9^\circ$ ,  $C \approx 100.6^\circ$
- Two people start walking on straight paths that make an angle of  $112^\circ$ . After one person has walked 1.2 miles and the other has walked 1.8 miles, how far apart are they? **about 2.5 mi**
- What is the area of a triangular banner with sides of length 28 cm, 35 cm, and 47 cm?  
**about 487 cm<sup>2</sup>**

### Online Quiz

Available at [classzone.com](http://classzone.com)

### Diagnosis/Remediation

- Practice A, B, C in Chapter 13 Resource Book, pp. 63–65
- Study Guide in Chapter 13 Resource Book, pp. 66–67
- Practice Workbook, pp. 191–192
- @HomeTutor

### Challenge

Additional challenge is available in the Chapter 13 Resource Book, p. 70.

### Quiz

An easily-readable reduced copy of the quiz (with answers) on Lessons 13.5–13.6 from the Assessment Book can be found on p. 850E.

47c. About 1 h 46 min;  $79.2^\circ$  W of N. *Sample answer:* The angle at hiker 1 is  $79.2^\circ$  and you have parallel lines at each hiker pointing in the North direction. The angle at hiker 2 is then an alternate interior angle, and is congruent.

## MIXED REVIEW

### PREVIEW

Prepare for Lesson 14.1 in Exs. 49–54.

Graph the function. 49–54. See margin.

- $y = 9 - 4x$  (p. 89)
- $y = 2\sqrt{x+7} - 3$  (p. 446)
- $y = |4x - 5|$  (p. 123)
- $y = 1.5e^{-x}$  (p. 492)
- $f(x) = x^2 - 10x + 12$  (p. 236)
- $g(x) = \ln(x + 4)$  (p. 499)

Divide using synthetic division. (p. 362) 55–58. See margin.

- $(x^3 + 8x^2 + 17x + 1) \div (x + 4)$
- $(x^4 + x^3 + 3x^2 + 7x + 4) \div (x + 2)$
- $(x^3 - 9x^2 + 26x - 17) \div (x - 3)$
- $(x^4 + x^3 - 31x^2 + 8x - 22) \div (x - 5)$

Perform the indicated operation and state the domain. (p. 428)

- $f + g$ ;  $f(x) = x + 7$ ,  $g(x) = 10x$   
 **$11x + 7$ , all real numbers**
- $f \cdot g$ ;  $f(x) = 3x - 2$ ,  $g(x) = 2x^3$   
 **$6x^4 - 4x^3$ , all real numbers**
- $f - g$ ;  $f(x) = 5x^{1/2}$ ,  $g(x) = -4x^{1/2}$   
 **$9x^{1/2}$ ,  $x \geq 0$**
- $f(g(x))$ ;  $f(x) = x^2 - 6$ ,  $g(x) = 8x + 11$   
 **$64x^2 + 176x + 115$ , all real numbers**

## QUIZ for Lessons 13.5–13.6

Solve  $\triangle ABC$ . (pp. 882 and 889)

- $A = 50^\circ$ ,  $B = 74^\circ$ ,  $c = 12$   
 **$C = 56^\circ$ ,  $a \approx 11.1$ ,  $b \approx 13.9$**
- $a = 20$ ,  $b = 14$ ,  $c = 23$   
 **$A \approx 59.7^\circ$ ,  $B \approx 37.2^\circ$ ,  $C \approx 83.1^\circ$**
- $A = 102^\circ$ ,  $C = 25^\circ$ ,  $a = 31$   
 **$B = 53^\circ$ ,  $b \approx 25.3$ ,  $c \approx 13.4$**
- $B = 53^\circ$ ,  $a = 41$ ,  $c = 29$   
 **$A \approx 82.4^\circ$ ,  $C \approx 44.6^\circ$ ,  $b \approx 33.0$**
- $C = 66^\circ$ ,  $a = 18$ ,  $c = 17$   
 **$A \approx 75.3^\circ$ ,  $B \approx 38.7^\circ$ ,  $b \approx 11.6$  or  $A \approx 104.7^\circ$ ,  $B \approx 9.3^\circ$ ,  $b \approx 3.0$**
- $C = 118^\circ$ ,  $a = 26$ ,  $b = 34$   
 **$A \approx 26.4^\circ$ ,  $B \approx 35.6^\circ$ ,  $c \approx 51.6$**
- $a = 49$ ,  $b = 52$ ,  $c = 38$   
 **$A \approx 63.8^\circ$ ,  $B \approx 72.2^\circ$ ,  $C \approx 44.0^\circ$**
- $A = 112^\circ$ ,  $B = 48^\circ$ ,  $c = 5$   
 **$C = 20^\circ$ ,  $a \approx 13.6$ ,  $b \approx 10.9$**

Find the area of  $\triangle ABC$ . (pp. 882 and 889)

- $B = 94^\circ$ ,  $a = 13$ ,  $c = 15$  **about 97.3**
- $a = 18$ ,  $b = 25$ ,  $c = 19$  **about 170.3**
- $a = 62$ ,  $b = 47$ ,  $c = 53$  **about 1210.4**
- $C = 18^\circ$ ,  $a = 16$ ,  $b = 11$  **about 27.2**
- $a = 27$ ,  $b = 21$ ,  $c = 37$  **about 279.1**
- $A = 70^\circ$ ,  $b = 44$ ,  $c = 36$  **about 744.2**
- GEOMETRY** The base of a right triangular prism has sides of length 8 centimeters, 10 centimeters, and 13 centimeters. The height of the prism is 5 centimeters. What is the volume of the prism? (p. 889) **about 200 cm<sup>3</sup>**

49–54. See Additional Answers beginning on p. AA1.

$$55. x^2 + 4x + 1 + \frac{-3}{x+4}$$

$$56. x^2 - 6x + 8 + \frac{7}{x-3}$$

$$57. x^3 - x^2 + 5x - 3 + \frac{10}{x+2}$$

$$58. x^3 + 6x^2 - x + 3 + \frac{-7}{x-5}$$